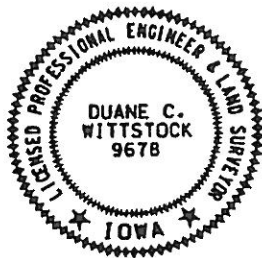


WEST DES MOINES


STANDARD CONSTRUCTION SPECIFICATIONS

FOR

SUBDIVISIONS



I HEREBY CERTIFY THAT THESE SPECIFICATIONS WERE PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY REGISTERED ENGINEER UNDER THE LAWS OF THE STATE OF IOWA.

 7-18-94
Duane C. Wittstock, P.E. March 28, 1994
Iowa Registration No. 9678
Registration Expires December 31, 1994

STANDARD SPECIFICATIONS

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PART 1 - GENERAL REQUIREMENTS

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1. INTENT

- A. The intent of the Specifications is to describe the performance requirements and standards of materials and construction for public improvements for new subdivisions and for public improvements built privately and dedicated to the City of West Des Moines, Iowa.
- B. The Specifications are intended to assist in implementing the Subdivision Ordinance and Comprehensive Plan, and to insure quality construction and compliance with requirements of City, County, State, and Federal Governments.
- C. Subdivider is expected to prepare and submit construction details for items not specifically covered in these Standard Specifications. Proposed details must be approved by City Engineer prior to construction.
- D. These Specifications are to be considered minimum standards for normal situations. Nothing in these Specifications shall preclude the City from requiring higher standards in special cases.
- E. The Standard Specifications are not intended to discourage new or innovative technology for methods, materials, or equipment. Submit proposed details to City Engineer for review and approval.
- F. Detailed Specifications are in outline form and include incomplete sentences. Omission of words or phrases is intentional. Supply omitted words or phrases by inference.

2. DEFINITIONS

- A. **Approved Plans** - Plans that have been reviewed and formally approved by the City Engineer and/or City Council and/or Planning and Zoning Commission.
- B. **City** - City of West Des Moines, Iowa, or the area within the corporate limits of the City of West Des Moines and such territory outside the City over which the City has jurisdiction or control by virtue of any constitutional or statutory provisions; City shall also mean the City Engineer, the Department of Public Works or any person or group of persons with delegated authority to enforce, interpret, modify, or waive City Codes and Standards.
- C. **City Engineer** - The Director of the Engineering Division or a person or persons employed by the City, either full or part-time, with the authority to perform official inspection, plan reviews and other functions as designated by the City Council and/or City Engineer for the enforcement of City Codes and Standards.
- D. **Contractor** - Any person, firm, partnership, association, or corporation constructing street and/or utility improvements for a subdivider, the City, or a utility company.
- E. **Standard Drawings** - The detailed drawings included in these Specifications.
- F. **Subdivision** - A subdivision of land, a plat of a subdivision, a planned unit development, a master plan, or a site plan for residential development.
- G. **Subdivider** - Any person, individual, firm, partnership, association, corporation, estate, trust, or any other group or combination acting as a unit, dividing or proposing to divide land so as to constitute a subdivision as defined herein and includes any agent of the subdivider.
- H. **Subdivider's Engineer** - The registered professional engineer, or his employees, under contract with the subdivider to provide the various engineering and technical duties defined and implied herein.
- I. **Subdivider's Surveyor** - The registered land surveyor, or his employees, under contract with the subdivider to provide the various surveying and technical duties defined and implied herein.
- J. **Subdivision Ordinance** - Any ordinance included in the West Des Moines Municipal Code relating to or establishing regulations for the subdivision and platting of land, for the preparation of plats or for the design, construction, inspection, and maintenance of planned improvements.
- K. **Utilities** - All franchised and non-franchised utility companies utilizing public right-of-way.

PART 1 - GENERAL REQUIREMENTS

3. GENERAL

- A. The Standard Specifications includes construction of site grading, earthwork and grading for pavement, sanitary sewers, storm sewers, paving, surface restoration, utilities, and other miscellaneous work for new subdivisions in the City of West Des Moines, Iowa.
- B. Refer to West Des Moines Water Works Standard Specifications for requirements on water mains.
- C. The City Engineer will answer questions concerning interpretation of the Standard Specifications or Standard Drawings. The interpretation of the City Engineer will be accepted as final.
- D. All necessary permits and licenses required for construction of the improvements shall be obtained by Subdivider or the Subdivider's Agent.
- E. Use and acceptance of the improvements: It may be necessary to utilize an improvement or improvements installed under these Specifications before the acceptance of the improvement by the City Council. This use may be by adjacent land owners (or others) through water or sewer connections or by access across an open pavement. Such use shall not be construed as acceptance of the improvement but rather as a customary practice for work done under this Specification. Acceptance shall be by City Council motion or resolution.

4. RESPONSIBILITIES

- A. Subdivider
 - 1. Assume total and direct responsibility for subdivision.
 - 2. Provides liaison services for all parties.
 - 3. Personally assumes responsibility or names an agent with full authority to make decisions on behalf of subdivider regarding issues which may arise.
- B. Subdivider's Engineer
 - 1. Prepare and certify construction drawings and specifications as necessary for construction of public improvements for subdivisions.
 - 2. Coordinate construction activities and schedules. Insure that City Engineer is advised of progress of work at regular intervals.

PART 1 - GENERAL REQUIREMENTS

3. Propose changes in the approved plans and specifications if necessary during construction. Submit details of any changes to City Engineer for review and approval prior to construction.
4. Provide construction staking by qualified personnel with sufficient points or stakes to provide adequate horizontal and vertical control to insure improvements are constructed as shown on approved plans and specifications.
5. Provide design services as required to resolve problems which develop during construction.

C. Contractor

1. Supervise and direct the construction work and be responsible for the means, methods, techniques, sequences, and procedures of construction including safety.
2. Employ and maintain at the project site a qualified supervisor or superintendent during construction to perform adequate supervision and coordination.
3. Furnish and install materials and perform all work and services required by the approved plans and specifications.

D. Project Representative

1. Project Representative is the City Engineer's agent and will act under the supervision and direction of the City Engineer. Subdivider to reimburse City the costs of providing Project Representative.
2. Observe construction to insure that the improvements are being constructed in accordance with the approved plans and specifications.
3. Report to City Engineer whenever any work is unsatisfactory, faulty, or defective.
4. Verify that required tests are conducted and that adequate records are maintained.
5. Shall not undertake any of the responsibilities of the Contractor.
6. Shall not authorize any deviation from the approved plans and specifications without written authorization from the City Engineer.

E. Utility Company

1. Utility companies shall be responsible for complying with all applicable aspects of

PART 1 - GENERAL REQUIREMENTS

the approved plans and Standard Specification for Subdivisions while performing work within the public right-of-ways.

5. INSURANCE REQUIREMENTS

- A. The Contractor shall purchase and maintain insurance to protect himself and City against all hazards enumerated herein for all work within City right-of-way. All policies shall be in the amounts, form, and underwritten by a company satisfactory to the City.
- B. All certificates of insurance required herein shall state that thirty (30) days written notice will be given to the City before the policy is cancelled or changed. All certificates of insurance shall be delivered to the City prior to the time that any construction operations are started.
- C. All of said Contractor's certificates of insurance shall be written by an insurance company authorized to do business in the State of Iowa.
- D. The Contractor shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the Contractor's operations, whether such operations be by himself or by any sub-contractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:
 - 1. Claims under Worker's or Workmen's Compensation, Disability Benefit, and other similar employee benefit acts;
 - 2. Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;
 - 3. Claims for damages because of bodily injury, sickness, or death of any person other than his employees;
 - 4. Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person;
 - 5. Claims for damages, other than to the work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; and,
 - 6. Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle.
- E. The insurance required shall be written on an occurrence form of policy for not less than any limits of liability specified herein, or required by law, whichever is greater:

PART 1 - GENERAL REQUIREMENTS

- | | |
|---|---|
| 1. General liability:
(including contractual, independent contractors, Broad Form Property damage, Personal Injury, Underground Explosion and Collapse hazards). | \$500,000 Combined Single limit per occurrence
\$500,000 Aggregate |
| 2. Automobile Liability:
(including all owned, non-owned and hire autos). | \$500,000 Combined Single Limit |
| 3. Worker's Compensation | Statutory Benefits
\$100,000 Coverage B |
| 4. Umbrella Liability:
(applying directly excess of above liability coverage). | \$1,000,000 Combined Single Limit
\$1,000,000 Aggregate |

6. BOND REQUIREMENTS

- A. The Contractor shall furnish a good and sufficient surety bond in the full amount of the construction cost for all public improvements. This surety bond, executed by the Contractor to the City, shall guarantee the payment to the City, their successor or assigns of all damage, loss, and expense which may occur to the City, their successor or assigns by reason of defective materials used, or by reason of defective workmanship done in the furnishing of materials and equipment in construction of public improvements, or in lieu thereof the City, their successors or assigns may require the Contractor to maintain such items in need of repair for the said periods specified herein.
- B. All provisions of the bond shall be complete and in full accordance with the statutory requirements. The bond shall be executed with the proper sureties through a company licensed and qualified to operate in the State and approved by the City. The bond shall be signed by an agent resident in the State.
- C. If at any time the surety on the Contractor's bond becomes irresponsible, the City shall have the right to require additional and sufficient sureties which the Contractor shall furnish to the satisfaction of the City within ten (10) days after notice to do so.
- D. Maintenance Bonds are required on the following public improvements. The bond term begins upon acceptance of the public improvement by the City.

PART 1 - GENERAL REQUIREMENTS

<u>DESCRIPTION</u>	<u>BOND TERM</u>
Sanitary Sewer	4 Years
Storm Sewer	4 Years
Paving	4 Years
Other	As may be required by City

7. PLANS AND SPECIFICATIONS

- A. Construction plans and specifications must be approved by City Engineer prior to beginning construction.
- B. Any addendum or modifications to the approved plans and specifications must be submitted and approved by City Engineer in writing prior to construction.
- C. Provide one (1) set of approved plans and specifications for each foreman and superintendent in charge of each crew on the job.

8. CONSTRUCTION FACILITIES

- A. Contractor shall provide suitable storage facilities necessary for property storage of materials and equipment.
- B. Provide telephone number where Contractor's representative can be reached during work day and on nights and weekends in event of emergency.
- C. Provide and maintain suitable sanitary facilities for construction personnel for duration of work; remove upon completion of work.
- D. Do not store construction equipment or materials on streets open to traffic. Location for storage of equipment by Contractor during non-working hours is subject to approval of City.

9. EXISTING UTILITIES

- A. Before starting operations in any area in the vicinity of utility facilities, the Contractor shall notify each utility of any operation which may affect their facilities. Such notice shall be provided to each utility sufficiently in advance of such operations to allow the utility time to mark the location of, relocate, adjust, or otherwise protect their facilities. The Contractor shall reach an agreement with each utility on appropriate action necessary to protect or relocate the utility facilities. The cost of such action to protect the facilities, except for locates, shall be borne by the Contractor. The One-Call System (1-800-292-8989) shall be utilized for locates for those utilities which subscribe to this service.

PART 1 - GENERAL REQUIREMENTS

- B. At all times the Contractor shall conduct his operations so that necessary clearances are maintained and said utility facilities are protected. The Contractor must comply with all Local, State, and Federal, or other regulations in performing work near utility facilities.
- C. Should the Contractor damage any of the utility facilities during Contractor's operations or determine the work cannot be performed safely, the Contractor shall immediately notify the utility involved and cease work until arrangements are made to prevent further damage or a serious accident. Any and all damage, including disruption of service, to any utility facility resulting from Contractor's operation will be repaired by the utility; the cost of said repairs and service disruption shall be borne by the Contractor.
- D. Failure of the Contractor to provide timely notice to the utility or to conduct his operations in such manner that proper clearances are maintained and the utility facilities are protected at all times will be grounds for the issuance of a Stop Work Order.

10. TRAFFIC CONTROL

- A. Prepare Traffic Control Plan for construction in City right-of-way and submit with construction plans.
- B. Provide signs, barricades, or other traffic control devices in accordance with "Manual on Uniform Traffic Control Devices" (MUTCD).
- C. Contractor shall check traffic control devices daily. Repair or replace damaged traffic control devices promptly.
- D. Flaggers may be required to protect the traveling public or workmen.
- E. Furnish and install permanent Type III barricades at all dead-end streets with no cul-de-sac.

11. EROSION PROTECTION

- A. Comply with soil erosion control requirements of Iowa Code and local ordinances. Protect against erosion and dust pollution on project site and any off-site borrow or deposit areas used for project. Developer is responsible for obtaining NPDES permit if applicable.
- B. Protect adjoining property including public sanitary and storm drainage systems and streets from any damage resulting from movement of earth or other debris from project site. Repair any damage immediately.

PART 1 - GENERAL REQUIREMENTS

- C. Prevent accumulation of earth or debris on adjoining public or private property from project site. Remove any accumulation of earth or debris immediately.
- D. Prevent repetition of any instance where earth or debris moves from project site to adjoining public or private property.
- E. Provide erosion control measures necessary to protect against siltation and erosion or flow of storm water. Maintain storm sewer system throughout construction period.
- F. Use straw bales and other means at all intakes, outfall structures, drainage courses, and swales to protect against siltation and erosion.

12. SUBMITTALS

- A. Provide construction schedule showing dates of starting and completing various portions or work.
- B. Submit following information for City's review:
 - 1. Materials test reports.
 - 2. Manufacturer's data for pipes, manhole covers and frames, castings, and other special items.
 - 3. Details of proposed methods of sheeting, shoring, and bracing.
 - 4. Such other information as City may request.
- C. Submit two (2) copies, certified by Subdivider's Engineer, of "As-Built" plans depicting any changes from the original approved plans including street grades, jointing patterns, sewer locations, service connections, manhole locations, and any additional pertinent information as needed or as required by the City Engineer: one set of which is produced on reproducible stable plastic drafting film; show work actually constructed clearly and concisely; provide information also on electronic media if available.

13. STANDARDS AND CODES

- A. Conform with and test in accordance with applicable sections of the latest revisions of the following standards and codes.
 - 1. American Association of State Highway and Transportation Officials (AASHTO).

PART 1 - GENERAL REQUIREMENTS

2. American Concrete Institute (ACI).
3. American Society for Testing Materials (ASTM).
4. Iowa Department of Transportation Standard Specifications (IDOT) and current Supplemental Specifications.
5. American National Standards Institute (ANSI).
6. American Water Works Association (AWWA).
7. American Welding Society (AWS).
8. Federal Specifications (FS).
9. National Electrical Safety Code (NESC).
10. Iowa Occupational Safety and Health Act of 1972. (IOSHA).
11. Manual of Accident Prevention in Construction by Associated General Contractors of America, Inc. (AGC).
12. American Disabilities Act (ADA).
13. Standards and Codes of the State of Iowa and the Ordinances of the City of West Des Moines, Iowa.
14. Other Standards and Codes which may be applicable to acceptable standards of the industry for equipment, materials, and installation under the contract.

14. MATERIALS TESTS

- A. Subdivider shall employ and pay for services of an independent testing laboratory for tests required to show compliance with Specifications. City will provide transportation of all samples to laboratory. Submit test results directly to City.
- B. Selection of testing laboratory subject to approval of the City.
- C. Provide materials tests as listed herein and as listed in detailed parts of the Specifications. Minimum testing frequency is listed; City Engineer reserves the right to require additional testing.
- D. Provide gradation and materials tests for pipe bedding and stabilizing material.

PART 1 - GENERAL REQUIREMENTS

- E. Certify that reinforced concrete pipe and special fittings are manufactured in accordance with applicable specifications. Provide copies of concrete cylinder compression tests made during manufacture of pipe.
- F. Certify that other pipe, manholes, fittings, and materials are manufactured in accordance with applicable specifications.
- G. Certify that reinforcing steel meets applicable specifications.
- H. Determine moisture density relations of soils encountered during construction in accordance with Standard Proctor Method in accordance with ASTM D 698. Provide graph of Proctor soil density versus moisture content for each soil encountered.
- I. Test trench backfill soil density and moisture at three tests per three foot (3') lift per four-hundred lineal feet (400 LF) of trench under streets and driveways and within street right-of-way at locations designated by City.
- J. Test pavement subgrade moisture and density at one test per six inch (6") lift per one-hundred and fifty lineal feet (150 LF) at locations designated by City.
- K. If trench backfill or pavement subgrade fail density tests, rework backfill or subgrade and retest until specified density is obtained; Subdivider shall pay all costs for retesting.
- L. Provide portland cement concrete mix designs: make two (2) concrete compression cylinders from trial batch of each proposed concrete mix before start of construction; provide seven (7) day and twenty-eight (28) day tests in accordance with ASTM C 39.
- M. Certify that sources of portland cement, asphaltic cement, and aggregates for concrete are IDOT approved. Provide analysis of materials used.
- N. Structural Concrete: prepare four (4) cylinders each day concrete is poured; provide seven (7) day and twenty-eight (28) day test in accordance with ASTM C 39.
- O. Portland Cement Concrete Pavement: prepare at least two (2) concrete compression cylinders for each two-hundred cubic yards (200 CY) placed; prepare at least four (4) cylinders each day concrete is poured; provide seven (7) day and twenty-eight (28) day tests in accordance with ASTM C 39. City will prepare concrete test cylinders.
- P. Core samples for pavement: locate as directed by City; measure thickness as directed; minimum one (1) core sample for each section of approximately one thousand square yards (1,000 SY).

PART 1 - GENERAL REQUIREMENTS

- Q. Test portland cement concrete slump and entrained air at project site. City will perform tests.
- R. Sample and test asphalt mix during construction to show conformance with Specifications.
 - 1. Provide two uncompacted samples of each mixture used each day from each project site at location designated by Engineer to independent testing laboratory.
 - a. Determine gradation and asphalt content.
 - b. Compact samples in laboratory and determine lab density, marshall stability, and flow.
 - 2. Cut a minimum of three four inch (4") diameter core samples per day; take samples at locations designated by Engineer.
 - a. Testing laboratory employed by Contractor will determine thickness, density, and percent air voids of core samples.
- S. Provide profilograph tests on pavement smoothness as specified in Parts 7 and 8.

15. FIELD TESTS

- A. Notify City when installation is complete and ready for testing. Notify City at least forty-eight (48) hours prior to field testing.
- B. City will supervise tests on sewers and other work.
- C. If tests results do not meet those specified, make necessary corrections and repeat.

16. FINAL REVIEW

- A. Contractor shall clean project site and remove all waste materials, tools, and equipment.
- B. Clean all storm sewers, intakes, manholes, and sanitary sewer manholes of all construction debris or soil.
- C. Broom clean all street surfaces.
- D. Notify City Engineer when construction is complete and ready for final review.

PART 1 - GENERAL REQUIREMENTS

- E. Subdivider and Contractor shall submit statements that improvements have been constructed in accordance with approved Plans and Specifications.
- F. Subdivider and Contractor responsible for maintenance of improvements and traffic control until accepted by the City.

PART 2 - EARTHWORK AND SITE GRADING

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| 2. DISPOSAL | 6. EXCAVATION |
| 3. CONCRETE AND ASPHALT
REMOVAL | 7. EMBANKMENT CONSTRUCTION |
| 4. TREE REMOVAL | 8. SUBGRADE PREPARATION |
| 5. MISCELLANEOUS REMOVAL | 9. FIXTURE ADJUSTMENT |
| | 10. GRANULAR SURFACING |

1. GENERAL

- A. This part of the Specifications includes excavation, demolition, grading, and incidentals to complete earthwork, site grading, and associated work.
- B. Reference to percent maximum density shall mean a soil density not less than the stated percentage of maximum density for soil as determined by ASTM D 698, "Moisture Density Relations of Soils" Standard Proctor Method.

2. DISPOSAL

- A. West Des Moines Public Works Department has first right of refusal of salvaged manhole sections, castings, culverts, and other salvageable items removed from public right-of-way.
- B. Remove from project site and dispose of vegetation, rubbish, building materials, concrete, asphalt, culverts, fences, and other non-salvageable materials.
- C. Remove from project site and dispose of organic material at sanitary landfill.

3. CONCRETE AND ASPHALT REMOVAL

- A. Saw cut concrete pavement full depth as required and at designated removal lines.
- B. Saw cut concrete driveways, sidewalks, and asphalt pavements full depth at designated removal limits.
- C. Concrete or asphalt broken or damaged by Contractor beyond designated removal lines shall be removed to new line designated by City and replaced by Contractor at no expense to City.

PART 2 - EARTHWORK AND SITE GRADING

4. TREE REMOVAL

- A. Remove from project site and dispose of trees located in the public right-of-way and other locations on the site as shown on the plans; grub, remove and dispose of stumps and roots. Trees, stumps, and roots may be buried on site if the burial location is shown on the final subdivision plat, written permission is obtained from the Iowa Department of Natural Resources, and all site specific conditions of the West Des Moines Departments of Public Works and Community Development are met.
- B. Coordinate removal with utility companies. Protect existing utilities during removal operations.
- C. Protect all trees not designated for removal during construction.

5. MISCELLANEOUS REMOVAL

- A. Remove and temporarily reset private mailboxes as necessary for construction.
- B. Replace private mailboxes in approximate original location after construction is complete; installation subject to approval of property owner, U.S. Post Office Department, and City.
- C. Notify West Des Moines Public Works Department when removal of street signs is necessary for construction; City will remove and reset street signs after construction.

6. EXCAVATION

- A. Strip grass and vegetation from construction area and dispose of at landfill or at location designated by City.
- B. Remove topsoil to minimum depth of eight inches (8") or as directed by City and stockpile for reuse to finish earth surfaces.
- C. Provide temporary drainage facilities to prevent damage when necessary to interrupt natural drainage or flow of artificial drains.

7. EMBANKMENT CONSTRUCTION

- A. Prepare site, place, and compact excavated materials to required elevation and cross section.

PART 2 - EARTHWORK AND SITE GRADING

- B. Scarify, disc, and roll foundation areas as necessary to provide proper bond with first layer of new fill.
- C. If soft or yielding materials are encountered, remove unstable materials and replace with suitable materials and compact.
- D. Place no roots, brush, grass, or other organic material in embankment; place no material on embankment when material or foundation is frozen.
- E. Step or bench all existing slopes greater than five (5) horizontal to one (1) vertical to connect existing grade with new fill.
- F. Select material for each portion of embankment with approval of City; select materials to avoid sharp change in texture.
- G. Use fill material free of lenses, pockets, streaks or layers, or materials differing from surrounding materials.
- H. Construct embankment in horizontal layers not more than eight inches (8") in loose thickness.
- I. Deposit each layer over full width of embankment as separate and distinct operation.
- J. After layer is deposited, smooth to uniform depth by means of suitable motor patrol or bulldozer.
- K. Compact selected materials in horizontal layers with tamping or sheepsfoot roller; use roller designed to provide at least two hundred pounds per square inch (200 psi) distributed on one (1) row of knobs; tamping feet must project not less than six and one-half inches (6-1/2") from face of drum.
- L. Compact layer by rolling with tamping type roller until full weight of roller is supported by tamping feet, but with not less than one (1) pass per inch of loose thickness of layer.
- M. Roller will be considered to be supported entirely on its tamping feet when feet do not penetrate more than three inches (3") into material being compacted.
- N. If soil is wet so that it will not sufficiently compact by one (1) passage of roller per inch of loose thickness, provide minimum of one discing per two inches (2") of loose thickness.

PART 2 - EARTHWORK AND SITE GRADING

1. Cut and stir full depth of layer.
 2. Allow interval of not longer than two (2) hours between successive discings, or as directed by City.
 3. After discing is completed, compact layer by specified rolling.
- O. If soil is dry so that it will not satisfactorily compact by rolling, moisten material before compaction; manipulate material to secure proper distribution of moisture before compaction.
- P. Place fill and compact on all sides of structures to same level as fill operation progresses to protect structures against displacement or other damage.
- Q. Areas adjacent to structures which cannot be tamped with rollers: hand tamp with mechanical tamper to same degree of compaction as specified for other parts of embankment.
- R. Whenever operations are suspended during periods of rain or the likelihood thereof, smooth and compact surface to shed water readily.
- S. Compact fill areas in street right-of-way under pavement and under utilities to not less than ninety-five percent (95%) maximum density; moisture content not less than two percent (2%) below optimum or more than three percent (3%) above optimum moisture content.

8. SUBGRADE PREPARATION

- A. Shape and consolidate subgrade in preparation for placement of pavement.
- B. Provide uniform composition of at least twelve inches (12") below top of subgrade under new paving plus two feet (2') on each side.
- C. Excavate top six inches (6") of all subgrade constructed in cut section, and scarify, pulverize, mix, and recompact next six inches (6") of subgrade with moisture and density control. Pulverize, mix and replace top six inches (6") of subgrade and compact with moisture and density control.
- D. Compact to not less than ninety-five percent (95%) maximum density; moisture content not less than two percent (2%) below optimum or more than three percent (3%) above optimum moisture content.

PART 2 - EARTHWORK AND SITE GRADING

- E. Remove stones over four inches (4") in size from subgrade and dispose of as directed by City.
- F. If ruts or other objectionable irregularities form in subgrade during construction, reshape and reroll subgrade before placing pavement; fill ruts or other depressions with material similar to other subgrade material and compact.
- G. Construct to elevation and cross section such that, after rolling, surface will be above required subgrade elevation.
- H. Complete final subgrade by excavation to grade by use of steel-shod template supported on side forms or support rollers or by use of automatically controlled subgrade excavating machine.
- I. Check subgrade elevation and grade by method approved by City prior to paving.
- J. Maintain subgrade prior to and during paving operations; repair any damaged or disturbed areas prior to paving.

9. FIXTURE ADJUSTMENT

- A. Set existing manholes to finished pavement grade or finished topsoil grade.
 - 1. Remove existing manhole castings and precast concrete cone section as required; add precast concrete manhole sections and replace cone section; manhole sections as specified in SANITARY SEWERS AND STORM SEWERS.
 - 2. Use adjusting rings to set casting at finished grade; twelve inches (12") maximum height; bed each ring with cold applied bituminous jointing material; Sewertite, Gibson-Homans or equal.
 - 3. Install new frame and cover for manholes located within new pavement; use castings as specified in SANITARY SEWERS AND STORM SEWERS.
 - 4. Pour manhole castings in slab; do not use box out without approval from City Engineer.

10. GRANULAR SURFACING

- A. Material: Class A crushed stone; IDOT 4120.04.

PART 2 - EARTHWORK AND SITE GRADING

- B. Temporary Accesses: Compact and shape subgrade to drain, place and maintain all weather surface capable of providing two way access to emergency vehicles and residents.
- C. Permanent Accesses (winter shutdown and permanent): Compact and shape subgrade to drain, place granular surfacing a minimum of twenty-four feet (24') wide by six inches (6") thick, uniformly spread and compact material; maintain surfacing until project acceptance.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

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1. GENERAL

- A. This part of Specifications includes excavation and backfill for sanitary sewers, storm sewers, and structures.
- B. Excavate all materials encountered to depth indicated or specified; comply with State and Federal safety regulations.
- C. Remove, replace, and repair fences, signs and other obstructions as necessary for construction; return all items to equal or better than original condition; comply with SURFACE RESTORATION.
- D. Pile excavated material suitable for backfill in an orderly manner sufficient distance back from edge of excavation to avoid roll back, slides, or cave-ins.
- E. Remove soil unsuitable for backfill; waste as directed by City.
- F. Where new construction crosses or closely parallels existing utilities or utility services, excavate in advance of pipe laying; determine location and crossing arrangement including line and grade.
- G. Excavate in open cut under existing streets, utilities, and structures except as required and as directed by City.
- H. Earth: all materials not classified as rock or rubble; includes clay, silt, sand, gravel, hardpan, disintegrated shale and rock debris, junk brick, loose stones, and boulders that can be removed by use of suitable excavating equipment.
- I. Rock: boulders larger than seventy-five per cent (75%) of rated capacity of excavating equipment in use or solid deposits so firmly cemented together that they cannot be removed without continuous use of pneumatic tools or blasting.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

- J. Rubble: buried concrete foundations, beams, walls , and other materials which require continuous use of pneumatic tools or blasting.
- K. Reference to percent maximum density shall mean a soil density not less than the stated percent of maximum density for soil as determined by ASTM D 698, "Moisture Density Relations of Soils" Standard Proctor Method.

2. SURFACING REMOVAL

- A. Remove existing street, sidewalks and driveways as directed by City.
- B. Remove on lines approximately parallel or perpendicular to centerline of trench.
- C. Cut vertically and horizontally on straight line; saw cut full depth of surfacing.
- D. Remove and replace surfacing damaged beyond removal limits.
- E. Remove from project site and dispose of removed surfacing.

3. EXCAVATION FOR STRUCTURES

- A. Remove topsoil above excavation to a depth of one foot (1') and store separately from remainder of excavated material. Following installation of structures and appurtenances and backfill of major portion of trench, place stored topsoil as final surface layer.
- B. Includes excavation for manholes, intakes, and other appurtenances.
- C. Excavate as required to firm, undisturbed soil; if excavation is carried below bottom of foundations, fill with granular pipe bedding material and compact.
- D. When unstable material which may not provide suitable foundation is encountered, notify the City.
 - 1. If material is considered unsuitable for foundations, Developer will submit detailed plan of action to City for approval.
 - 2. If removal of unstable material is authorized, overexcavate and replace with stabilizing material.
- E. Provide sheeting, shoring, and bracing where required to hold walls of excavation to protect existing structures or utilities or to provide safety of workmen.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

4. TRENCH EXCAVATION

- A. Remove topsoil above trench in non-paved areas to a depth of one foot (1') and store separately from remainder or excavated material. Following installation of pipe and backfill of major portion of trench, place stored topsoil as final surface layer.
- B. Keep width of trench as narrow as possible and still provide adequate room for backfill, jointing, and compaction.
- C. Maximum width of trench at top of pipe: as shown on Standard Drawings.
- D. Keep sides of trench as nearly vertical as practical; maintain vertical walls below top of pipe.
- E. Excavate to required grade to provide proper bedding; if trench is overexcavated, fill with stabilizing material.
- F. When unstable material which may not provide suitable foundation for pipe is encountered, notify the City.
 - 1. If material is considered unsuitable for pipe foundation, Developer will submit detailed plan of action to City for approval.
 - 2. If removal of unstable material is authorized, overexcavate and replace with stabilizing material. Place pipe bedding on top of stabilizing material.
- G. Stabilizing material: sharp, clean crushed stone; comply with following gradation:

<u>Sieve</u>	<u>Per-Cent Passing</u>
2-1/2"	100
2"	90-100
1-1/2"	35- 70
1"	0- 15
1/2"	0- 5

- H. Remove large clods, stones, and other foreign material from bottom of trench.
- I. Bottom of storm sewer or sanitary sewer service trench:
 - 1. Provide pipe bedding for flexible or rigid pipes as shown on Standard Drawings.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

2. Granular pipe bedding: sharp, clean crushed stones; comply with following gradation, dependent upon pipe diameter:

<u>Sieve</u>	<u>Pipe Diameter</u>	
	<u>4" - 18"</u> <u>Percent Passing</u>	<u>Over 18"</u> <u>Percent Passing</u>
1-1/2"	----	100
1"	100	95-100
3/4"	80-95	35- 70
1/2"	35-60	25- 50
3/8"	20-40	10- 30
No. 4	0- 5	0- 5

3. Alternate granular pipe bedding material: IDOT 4120.04 Class A crushed stone may be used in stable trench conditions.
4. City may authorize change in gradation subject to materials available locally at time of construction.
5. Provide suitable bell holes at each pipe joint so bells provide no point bearing; provide access around circumference of pipe for proper jointing.
6. Compact pipe bedding by rodding or slicing with shovel. No lift shall have a depth greater than six inches (6").

5. ROCK AND RUBBLE EXCAVATION

- A. If trench bottom is extremely hard or is in rock or rubble where there is a possibility of pipe being subjected to point bearing:
 1. Overexcavate trench bottom six inches (6") minimum below grade.
 2. Backfill overexcavation with suitable material; place pipe bedding material on top of resulting bottom of trench.
- B. Use of explosives: submit detailed plans to City outlining all proposed blasting operations, locations, methods, and use of mats and other safety measures.
 1. Obtain written approval from City before using explosives.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

2. Use thoroughly experienced demolition personnel.

C. Dispose of excavated rock and rubble not suitable for backfill.

6. SHEETING, SHORING, AND BRACING

A. Where required or when the material to be excavated is unstable, or the bottom of the trench will not hold its form when excavated, install tight sheeting and shoring to a depth necessary to control the action of the bottom.

B. Support to prevent any movement which would in any way injure the sewer or adjacent property, private or public utilities, minimize the width necessary for proper construction procedures, or otherwise injure or delay the work.

C. Contractor to assume all liability for any and all damages to property, or injury to workmen and other persons, which may occur if sheeting is not used.

D. Contractor shall furnish and place such sheeting and shoring, sheet piling, planking, and bracing as may be required to support both sides of excavation.

E. Contractor shall install sheeting and shoring in a manner to minimize vibration in adjacent buildings and structures.

F. Leave in place all sheeting below a level two feet (2') above top of pipe.

G. Leave sheeting and shoring in place two feet (2') over top of pipe when removal might damage new pipe.

7. CONFLICT WITH EXISTING UTILITIES AND SERVICES

A. Provide temporary support for existing water, gas, telephone, power and other utility services that cross the trench until backfilling of the trench has been completed; do not use support methods which transfer weight or forces to other utilities.

B. All cables, conduit, and pipe exposed during construction will be secured in such a manner that no deflection or sagging occurs during or after construction. All backfill shall be natural earth materials excluding rocks, foreign materials, or other abrasive materials that may be injurious to the cables.

C. Compact backfill under existing utility crossing to ninety-five per cent (95%) maximum density; moisture content not less than two percent (2%) below optimum or more than three percent (3%) above optimum moisture content.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

D. Drain tile repair:

1. Notify City promptly when drain tile are encountered during excavation; note location of tile; promptly repair all drain tile damaged during construction.
2. Replace drain tile with length of ductile iron pipe as specified for sanitary sewers or helically corrugated steel pipe with standard galvanizing coating extending at least twelve inches (12") into undisturbed earth on each side of trench.
3. Diameter of replacement piping greater than or equal to existing tile diameter.
4. Install steel or reinforced concrete support beams as required and subject to City's review.
5. Connect to existing pipe with manufactured pipe adaptor, coupling or six inches (6") thick by twelve inches (12") long concrete collar.
6. Compact backfill under drain tile repair to ninety-five percent (95%) maximum density for distance equal to trench depth each side of drain tile.
7. Leave repair exposed for inspection by City.

8. TUNNELING

- A. Tunneling will be required under railroads, highways, and where stipulated in writing by City. Contractor to have copy of approved permit on site during tunneling.
- B. Sanitary sewer must be installed in casing pipe under railroads; comply with Iowa DOT requirements at all highway crossings.
- C. Steel casing pipe:
 1. Smooth wall welded steel pipe, ASTM A 139; one-fourth inch (1/4") minimum wall thickness or as required by IDOT or railroad.
 2. Casing pipe diameter: exceed maximum O.D. of carrier pipe and joints by four inch (4") minimum.
 3. Welded joints: comply with America Welding Society (AWS) code of Arc and Gas Welding in Building Construction.
 4. Bevel or space ends of pipe to insure full penetration of weld for thickness of pipe.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

5. Coat outside of pipe with asphalt liquid, Iowa Paint Mfg. Co., No. 31, or equal.
6. Use for highway crossings, railroad crossings, or where directed by City.
- D. Obtain approval of City, Railroad, or IDOT on methods before starting; auger or jack pipe in place.
- E. If pipe is augured, clean out pipe upon completion.
- F. If pipe is jacked, clean out pipe as work progresses; use dry bore method.
- G. Maintain correct vertical and horizontal alignment, tolerance for sanitary sewers:
 1. Vertical: 0.2 foot or as to permit gravity flow in proper direction.
 2. Horizontal: 0.5 foot.
- H. Attach spacers to carrier pipe to center carrier pipe in casing pipe.
- I. Fill annular space between casing and carrier pipe with flowable mortar.
- J. Maintain street, highway, or railroad for full use by traffic at all times.
- K. Tunneling below or adjacent to structures or paving: do work in manner to prevent settlement of structures or paving.

9. DEWATERING

- A. Do all work in dry; provide for handling water encountered during construction.
- B. Lay no pipe in or pour no concrete on excessively wet soil.
- C. Prevent surface water from flowing into excavation; remove water as it accumulates.
- D. Divert stream flow away from areas of construction.
- E. Do not pump water onto adjacent property without approval of property owner.
- F. Do not use sanitary sewers for disposal of trench water.
- G. Permanent dewatering facilities may be required if groundwater is excessive.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

10. BACKFILL FOR STRUCTURES

- A. Backfill after concrete or masonry has cured.
- B. Backfill with suitable material removed from excavation except where other backfill is specified; use no debris, frozen earth, large clods, or stones.
- C. Backfill simultaneously on all sides of structure; save structure from damage at all times.
- D. Compact backfill at structures to density not less than specified for adjacent trench.
- E. Comply with Surface Restoration and with compaction requirements in TRENCH BACKFILL shown below.

11. TRENCH BACKFILL

- A. Backfill trench immediately after location of connections and appurtenances have been recorded.
- B. Construct junction boxes, manholes, intakes, and appurtenances and backfill as work progresses. Allow no more than four-hundred feet (400') of trench to be open at one time.
- C. Backfill with suitable excavated material or borrow materials. Use no large stones, large clods, organic matter, rubbish, or frozen material.
- D. If excavated materials have excessive soil moisture and cannot be compacted to specified density, dry material by discing or mixing with dry soils or remove and replace with suitable borrow materials.
- E. If sufficient suitable excavated material is not available, remove and dispose of unsuitable excavated material. Furnish suitable borrow materials to complete trench backfill.
- F. Backfill simultaneously on both sides of pipe.
- G. Hand place and compact granular pipe bedding adjacent to pipe as shown on Standard Drawings. Provide clay plug in trench at two hundred foot (200') intervals.
- H. Place and compact granular bedding material as shown on Standard Drawing. Hand place minimum of six inches (6") of suitable material over top of granular material. Protect pipe.

PART 3 - EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES

- I. Backfill trenches within street right-of-way with suitable material in maximum eight inch (8") lifts and compact to not less than ninety-five percent (95%) maximum density; moisture content not less than two percent (2%) below optimum or more than three percent (3%) above optimum moisture content.
- J. Backfill trenches in other areas with suitable material in maximum twelve inch (12") lifts and compact to not less than ninety per cent (90%) maximum density; moisture content not less than three percent (3%) below optimum or more than five percent (5%) above optimum moisture content.
- K. Compact backfill with pneumatic or mechanical tampers adjacent to or within twelve inches (12") over pipe. Rollers or vibrating plate compactors may be used after sufficient backfill has been placed to assure that such equipment will not damage or disturb the pipe.
- L. Do not use drop hammers, backhoe bucket, flooding, or jetting for compaction of trench backfill.
- M. Fill upper twelve inches (12") of trench in unpaved areas with topsoil saved from excavation.
- N. Comply with SURFACE RESTORATION.

PART 4 - SANITARY SEWERS

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1. GENERAL

- A. This part of the Specifications includes material and installation procedures for construction of sanitary sewers and appurtenances.

2. PIPE MATERIAL AND JOINTS

- A. Polyvinyl chloride (PVCT) composite truss pipe:

1. Semi-rigid composite pipe constructed with inner and outer polyvinyl chloride walls with truss type structure between inner and outer walls; truss voids filled with lightweight concrete.
2. Dimensional, performance, and use in accordance with ASTM D 2680.
3. Rubber gasket joints, ASTM D 3212.
4. Use for sanitary sewer eight inch (8") to fifteen inch (15"); provide granular bedding for flexible pipe as shown on Standard Drawings.
5. Protect PVCT from direct sunlight. Cover pipe or store indoors.

- B. Lined Reinforced Concrete Pipe (RCP): ASTM C 76.

1. Minimum Class IV, Wall B or C pipe, reinforced as shown in Table 4 of ASTM C 76.
2. Rubber ring gasket type, flexible joint; O-ring gasket, or equal; conform with ASTM C 443.

PART 4 - SANITARY SEWERS

3. Tongue and groove, machined ends.
 4. Six foot (6') minimum laying length.
 5. Label each piece by class and show date of manufacture.
 6. Lining as specified hereinafter.
 7. Concrete pipe lining: two-component coal-tar epoxy-polyamide black paint; line pipe barrel and joint surfaces; lining compound: SSPC Paint Specifications No. 16-Table 1, expoxide resin content thirty-four percent (34%) to thirty-five percent (35%) by dry film weight, forty (40) mils minimum sag resistance, minimum solids eighty-two per cent (82%) by volume.
 8. Cure pipe, sandblast and thoroughly clean surface, remove all loose materials.
 9. Apply lining by airless spray to pipe barrel, prime all pipe with coating thinned to fifty per cent (50%) solids in accordance with manufacturer's recommendations, coverage rate: two hundred and fifty square feet (250 SF) per gal., apply one lining coat over prime coat, minimum dry film thickness: thirty (30) mils, one coat; apply lining by brush to all joint surfaces, minimum dry film thickness: eight (8) mils, one (1) coat.
 10. Conform with recommendations of lining manufacturer; cure pipe lining five (5) days, minimum.
 11. Use for sanitary sewer fifteen inches (15") and larger; provide granular bedding for rigid pipe as shown on Standard Drawings.
- C. Vitrified Clay Pipe (VCP): ASTM C 700-75, extra strength.
1. Factory fabricated compression joints, ASTM C 425.
 2. Use for sanitary sewer eight inches (8") to fifteen inches (15"); provide granular bedding for rigid pipe as shown on Standard Drawings.
- D. Polyvinyl Chloride Pipe (PVC): ASTM D 3034, SDR 26 or SDR 23.5; PVC plastic in accordance with ASTM D 1784, Cell Classification 12454-B.
1. Elastomeric gasket or solvent welded joints.
 2. Use for sanitary service lines only: six inches (6") minimum; provide granular bedding for flexible pipe as shown on Standard Drawings.

PART 4 - SANITARY SEWERS

3. Protect PVC from direct sunlight. Cover pipe or store indoors.

E. Ductile Iron Pipe (DIP):

1. AWWA/ANSI C150/A21.50 manufactured in accordance with AWWA/ANSI C151/A21.51; thickness Class 52; coat outside with standard coating; coat inside with standard cement lining AWWA/ANSI C104/A21.4.
2. Mechanical or push on joints AWWA/ANSI C11/A21.11.
3. Use for sanitary service lines and sanitary sewers at water main conflicts; provide granular bedding for rigid pipe as shown on Standard Drawings.

3. MANHOLES

A. Standard manholes:

1. Precast reinforced concrete manhole sections conforming to ASTM C 478, forty-eight inches (48") diameter, five inches (5") minimum wall thickness, one cage reinforcing , minimum 0.12 square inches reinforcement per lineal foot of pipe wall.
2. Precast integral concrete manhole bottom section and base, or cast in place base.
3. Joints: rubber ring gasket type, flexible joint, O-ring gasket or equal; conform to ASTM C 443.
4. Steps: Aluminum or copolymer encapsulated steel reinforcing bar; space sixteen inches (16") on centers, top step six inches (6") below top of cone sections.
5. Conform to Standard Drawings.

B. Pipe connections:

1. Use watertight rubber gasket or flexible sleeve precast into manhole wall unless permitted otherwise by City.
2. Connection to allow differential settlement of pipe and manhole without leakage.
3. Conform to Standard Drawings.

C. Castings: Shall be as specified or as shown on the Standard Drawings or Plans.

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1. Type A Casting: Use outside paved areas.
 2. Type C Casting: Use outside paved areas subject to flooding.
 3. Type B Casting: Use in paved areas; use Type C checkered top lid.
 4. Type D Casting: Use in paved areas subject to flooding; use Type C checkered lid.
 5. Provide concrete adjusting rings on manholes as necessary to place cover at grade or to required elevation; provide two adjusting rings minimum; maximum height of manhole adjustment using adjusting rings, twelve inches (12"); bed each ring with cold-applied bituminous jointing compound.
 6. Securely bolt castings to precast manhole sections with a minimum of 2-1/2" bolts.
- D. Manholes and castings shall be suitable for AASHTO HS-20 Highway loadings.
- E. Provide smooth, semi-circular invert, same size as outlet pipe, through manhole; make curve as large a radius as practical for changes in flow direction; all water shall drain freely from manhole; slope floor one-half inch (1/2") per foot toward invert.
- F. Completely waterproof exterior joints of sanitary sewer manholes with two coats of a heavy-bodied tar or rubber asphalt; coat area minimum six inches (6") each side of joint.

4. SEWER PIPE INSTALLATION

- A. Provide bedding and backfill as shown on standard drawings and as specified in EXCAVATION AND BACKFILL FOR PIPES AND STRUCTURES.
- B. Before laying pipe, verify all measurements at site; make necessary field measurements to accurately determine sewer makeup lengths or closures.
- C. Begin at lowest point in line; lay bell ends pointing upstream.
- D. Visually inspect pipe for defects before carefully lowering into trench; lay true to line and grade; provide for uniform bearing of the pipe barrel on the trench bottom while avoiding point bearing on the bells.
- E. Provide smooth and uniform invert; bear spigots against bell shoulders.
- F. Make joints with equipment recommended by pipe manufacturer; do not use backhoe to push joints together.

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- G. Seal all cut edges of PVCT pipe with coating recommended by manufacturer.
- H. Keep pipe free of all dirt and foreign material; clean pipe interior of all foreign material before lowering into trench; keep clean by securely closing open ends of pipes and manholes; plug open end of pipe at end of work day and when work is not in progress.
Line and grade:
 - 1. Use laser light equipment or batter boards for line and grade control.
 - a. Use direction equipment to monitor laser light to prevent movement or drift of line from line and grade.
 - b. Use minimum of three (3) batter boards not more than twenty-five feet (25') apart.
 - 2. Check line and grade of each pipe length; horizontal and vertical alignment of the installed pipe shall not vary more than plus or minus one-fourth inch (1/4").
 - 3. Check sewer grade at maximum one hundred foot (100') intervals with level and level rod.
 - 4. Continuously check alignment of sewer by flashing light between manholes or between last piece of pipe laid and opening at downstream manhole.
 - 5. Correct misalignment, displacement, or otherwise defective sewer.

5. CONFLICT WITH EXISTING UTILITIES

- A. Provide temporary support for existing water, gas, telephone, power, and other utility services that cross trench until backfilling of the trench has been completed.
- B. Compact backfill under existing utility crossing to ninety-five per cent (95%) maximum density; moisture content not less than two percent (2%) below optimum or more than three percent (3%) above optimum moisture content.

6. CONNECTION BETWEEN DISSIMILAR GRAVITY PIPE

- A. Use manufactured special adaptors or couplings with full-width stainless steel bands whenever possible.

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- B. If coupling is not available, use concrete collar six inches (6") thick and twelve inches (12") each way from joint; reinforce with 6" x 6"-W2.9 x W2.9 welded wire fabric. Concrete collar to be approved by City Engineer prior to use.

7. WATER MAIN CONFLICTS

- A. Horizontal separation of gravity sewers from water mains: separate gravity sewer mains from water mains by horizontal distance of at least ten feet (10') unless:
 - 1. The top of sewer main is at least eighteen inches (18") below bottom of water main.
 - 2. The sewer is placed in separate trench or in same trench on bench of undisturbed earth at minimum horizontal separation of three feet (3') from the water main.
 - 3. These are minimum requirements; other regulating authorities may require more stringent limitations.
- B. Sewers with less than ten feet (10') lateral clearance and top of sewer less than eighteen inches (18") below bottom of water main: use ductile iron pipe as specified for sewer.
- C. Where new sewer crosses over water main or service or where top of sewer is within eighteen inches (18") of bottom of water main or service: provide twenty feet (20') length of ductile iron pipe as specified for sewer centered on the water main; backfill trench with low permeability soil for twenty feet (20') length centered on crossing.

8. SERVICE CONNECTIONS

- A. Install service connections where shown on plans or as directed by the City; conform to Standard Drawings.
- B. Service pipe: ductile iron pipe (DIP) or polyvinyl chloride (PVC) SDR 26 or SDR 23.5, minimum size six inches (6").
- C. Wye or Tee: Use fittings for service connections.
- D. Install watertight stopper in end of new sewer services stubbed to vacant lots; install steel fence post painted green to mark location.
- E. Use wye or tee branch where invert of sewer is less than ten feet (10') below ground surface or where required to avoid water main conflicts; rotate branch minimum of thirty degrees (30°) from horizontal.

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- F. Use tee branch and riser pipe where sewer invert is twelve feet (12') or more below ground surface; riser shall be extended up to ten feet (10') below ground surface; conform to Standard Drawings.
- G. Service connections on sewers where wyes or tees were not originally installed with sewer, shall be installed by cutting out a section of main line sewer and having a wye fitting installed or a sewer tap shall be made with a mechanical sewer tap machine designed for that purpose and a factory made sewer tap saddle installed. The new wye fitting or sewer tap shall have water tight joints. The sewer tap saddle shall not extend beyond the inside of the main line sewer. The installation shall be inspected by the City Engineer prior to backfill.
- H. Backfill trench after exact location of service connection has been recorded. Two compaction tests per service are required as specified for TRENCH BACKFILL.

9. TESTING

A. Deflection tests:

- 1. Perform deflection tests on PVCT Truss sewer pipe after final backfill has been in place at least thirty (30) days.
- 2. Run deflection test using a rigid ball or mandrel with diameter equal to ninety-five per cent (95%) of the pipe; perform without mechanical pulling devices.
- 3. No pipe shall exceed a deflection of five per cent (5%).

B. Leakage Tests:

- 1. Maximum allowable infiltration or exfiltration for any new sanitary sewer section, including all manholes, is two hundred (200) gallons per inch of diameter per mile of pipe per day. Test manholes separately as specified below.
- 2. Line Low-Pressure Air Test: ASTM C 828:
 - a. Plug ends of line and cap or plug all connections to withstand internal test pressures.
 - b. Introduce low pressure air until internal air pressure is four pounds per square inch (4.0 psi) greater than the average back pressure of ground water above the pipe.

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- c. Allow two (2) minutes for air pressure to stabilize.
- d. Time for pressure to decrease from 3.5 to 2.5 psi greater than the average back pressure of any ground water above the pipe shall not be less than the time in the following table for the given diameters:

<u>Pipe Diameter</u> <u>(inches)</u>	<u>Time</u> <u>(minutes)</u>
6	3.0
8	4.0
10	5.0
12	5.5
15	7.0
18	8.5

- e. Repeat test as necessary after all leaks and defects have been repaired.
3. Manhole exfiltration test:
- a. Plug inlet and outlet of manhole and fill with water to at least two feet (2') above top of highest pipe or two feet (2') above ground water table, whichever is higher; let water stand in manhole for one (1) hour and then refill to original elevation; measure water loss after next hour.
 - b. The allowable manhole leakage shall not exceed 0.05 foot per hour.
 - c. Alignment Test - Sewers shall be checked for alignment by either using a laser beam or lamping. The light shall be visible through the section of pipe lamped. The results of the alignment test to be evaluated by the City.

10. SEWER ABANDONMENT

- A. Contact Engineering Division of the Department of Public Works for specific requirements.